Ever since the first hominids left Africa, human beings have been on the move. The canoe was invented in 8,000 B.C., and the first form of public transportation was a stagecoach operated in Paris in 1662. Fast forward to today’s self-driving car prototype, and it’s clear just how far we’ve come.

Morning traffic on the Southeast Expressway in Dorchester. (David L. Ryan/Globe Staff)
What is success?

Has the progress in transportation technology translated into the betterment of our mobility system? No!
Four Technology Themes in Mobility

1. **Mobility Decarbonization**
   - To reduce carbon emission by transitioning from fossil fuel to sustainable alternatives:
     - Electric vehicles
     - EV charging
     - Battery technology
     - Fuel Cells
     - Hydrogen

2. **Autonomous Driving**
   - To enable vehicles to operate without or with minimal human intervention, aiming to replace or assist human drivers, including:
     - Sensors & processors
     - Localization & Mapping
     - Perception software
     - Full-stack players

3. **Connected Vehicle Tech**
   - To enable real-time data exchange with other vehicles, infrastructure, and external systems.

4. **Next-Gen Aviation & Space Tech**
   - Sustainable aviation fuel; autonomous flights; eVTOL; hydrogen aircraft;
   - SpaceX, BlueOrigin; launch, satellite, manufacturing, in-space services

---

**MIT Mobility Venture Fall 2023**

For each theme, we will cover the following content:

- **A** The Opportunity
- **B** Investment Activities
- **C** Trends
- **D** Market Landscape
- **E** Highlight Startups
Different framings of transportation

As a congestion problem
As a sustainability problem
As a social justice problem
As a personal identity problem
As an urban creativity problem
As a public health problem
Changes in Transportation

Technology
- Automation
- Electrification
- 5G/Connected
- Shared economy
- …

Data
- Ubiquitous sensing
- AI / computing
- Cybersecurity
- …

Value
- Climate change
- Future of work
- Public health
- Social justice
- Urban livability
- …
What defines the future of mobility?
Behavior + Computation
Behavioral thinking

is travel social?

is travel emotional?

is time absolute?
Business Decision

- EV range anxiety
- Ridesharing Pricing
- AV adoption
- Congestion charge
- Ownership vs access
- Car profit margin
- ...

Behavioral Thinking

- Emotional—> rational
- Preference of sharing
- Risk preference
- Price salience
- Option value
- Car pride
- ...

Emotional—> rational
Preference of sharing
Risk preference
Price salience
Option value
Car pride
Behavioral Science
- Emotional
- Social
- Perceptual

Transportation Technology
- Electrification
- Automation
- Connectivity
- Sharing

Computational Foundation
- Representation
- Explanation
- Prediction
- Control
- Creation
How is MIT contributing?
MIT Mobility Initiative

mmi.mit.edu
How is MIT contributing?

Solve short-term technical problems

Develop medium-term platforms and capacity

Catalyze strategic, institutional, and social changes
Our Mission

The MIT Mobility Initiative (MMI) is a global platform to accelerate a **safe, clean and inclusive** mobility system through research, education, entrepreneurship and engagement.

**Research**
Catalyze cross-disciplinary research that provides insight to strategic challenges for industry and society.

**Education**
Manage and enhance MIT’s transportation degree programs and expand the executive education offering.

**Entrepreneurship**
Leverage MIT’s innovation ecosystem to spin off mobility tech startups and support existing startups.

**Engagement**
Foster direct interaction with leaders from business and government on the “front lines” of the mobility revolution.
Q1:
How many people were killed in road traffic crashes in the US in 2021?
42,915
Collective Sensing for Connected Corridor Management

Principal Investigators:
• Sanjay Sarma, Professor of Mechanical Engineering
• Dajiang Suo, Research Scientist

Research Questions:
• How can infrastructure-assisted collective sensing V2X systems enhance both safety and traffic efficiency?
• How can cyber threats to infrastructure sensors be mitigated in connected vehicle deployment?
• What is the optimal allocation of sensors to balance resolution, latency and cost?
Safety as a Performance Measure for Autonomous Mobility

Principal Investigators:
• Cathy Wu, Assistant Professor of Civil & Environmental Engineering & MIT Institute for Data, Systems and Society
• Ao Qu, MIT Graduate Student

Research Questions:
• What is the trade-off between safety and system performance for human-driven vehicles? How would this differ for autonomous vehicles?
• To what extent can large-scale traffic reconstruction contribute to the question "how safe is safe enough" for autonomous vehicles?
An urban agenda for the deployment of autonomous vehicles
Q2: What finances the US transportation infrastructure?
US Transportation Finance: Beyond the Gas Tax

Principal Investigator:
- Jim Aloisi, Lecturer and MMI Researcher

Research Questions:
- What will be the impact of rising EV adoption on gas tax revenue?
- What are the alternatives to replace lost revenue?
Convergence of three industries?

Gas Tax

Toll Road

Car Insurance
Principal Investigators:
- David Keith, Assistant Professor of System Dynamics, Sloan School of Management
- Jim Womack, MMI Fellow

Research Questions:
- Why is the reliability of US public charging infrastructure so poor?
- What could be done to improve the situation?
Electric Vehicle Charging Urban Optimization

Principal Investigators:
• Alex Jacquillat, Asst Professor of Operations Research and Statistics, MIT Sloan School of Management
• Daniel Freund, Asst Professor of Operations, MIT Sloan School of Management

Research Questions:
• Where to locate public electric vehicle chargers in an urban setting?
• How many and what type (power) of chargers should be used in which locations?
• How to optimize charging infrastructure for access, utilization, equity, etc.?
Why does the US Public Transit Suffer and How to Improve it?

Principal Investigators:
• Jim Aloisi, Lecturer and MMI Researcher
• Jinhua Zhao, MMI Faculty Director

Consortium Members:
• Seven top transit agencies in the US: New York, Chicago, San Francisco, Seattle, Los Angeles, Washington DC and Boston

Sample Research
• Future of work and transit ridership growth
• Improve transit operation and planning with machine learning
MIT serving the public
Launched in 2020, the MMI Mobility Forum has run 85 sessions, reaching ~14,000 audience across the globe. All sessions are open to the public, recorded and annotated, serving as free education and training resource for universities, corporations, and public sectors.

**Spring 2023 MMI Forum Series**

- **Envisioning Profitable Autonomous Transit Networks**
  Alain Kornhauser
  Director Transportation Program, Princeton University

- **Telemobility, Hybrid Work and the Next Normal**
  Hani Mahmassani
  Director Northwestern University Transportation Center

- **Tectonic Shifts in Science, Technology and Industrial Policy**
  Liz Reynolds
  MIT Lecturer, Former Special Asst. to the President for Manufacturing
  David Mindell
  MIT Professor

- **Modelling Sustainable Options: Habit and Perceptions**
  Juan de Dios Ortuzar
  Emeritus Professor, Pontificia Universidad Católica de Chile

- **The Case Against EVs as Transportation Policy One**
  Robin Chase
  Co-Founder and former CEO of Zipcar, Buzzcar and GoLoco

- **Reinforcement Learning to Sequential Decision Analytics: Transportation Applications**
  Warren Powell
  Professor Emeritus at Princeton; Chief Innovation Officer at Optimal Dynamics

- **How Safe is Safe Enough for Autonomous Vehicles?**
  Philip Koopman
  Professor, Carnegie Mellon University

- **From Citations to Collective Wisdom in Travel Behavior Research**
  Joan Walker
  Professor, Univ. of California, Berkeley

- **What About Pedestrians in Urban Mobility?**
  Andres Sevstuk
  MIT Professor
  Peter Norton
  Professor, University of Virginia
  Kris Carter
  Chair, New Urban Mechanics, City of Boston

- **Last-Mile Logistics on Steroids: Delivering the Future Needs of Consumers**
  Matthias Winkenbach
  Director, MIT Megacity Logistics Lab

- **Traffic Management Challenges in Advanced Air Mobility**
  Hamsa Balakrishnan
  MIT Professor

- **AI and Public Transit**
  Jinhua Zhao
  MIT Professor and Founding Director, MIT Mobility Initiative

- **Entrepreneurship Returns to the Auto Industry: Electric Vehicle Case Study**
  Charlie Fine
  MIT Professor
MMI Mobility Forum

**Theme One: Clean, Safe and Inclusive Mobility**
- Decarbonization 12
- Safety, Security and Resilience 7
- Society and Equity 6

**Theme Two: Community, Policy, and Cities**
- Community 6
- Cities and Pedestrians 10
- Policy 10

**Theme Three: Computation & Behavioral Analytics**
- Control and Optimization 9
- Machine Learning 9
- Behavior 11
- Future of Work 3

**Theme Four: Technology and Systems**
- Aerial Mobility 6
- Automation 12
- Public Transport 8
- Shared Mobility 6
- Supply Chain 5

**Theme Five: Investment, Finance and Entrepreneurship**
- Investment 1
- Finance 1
- Entrepreneurship 1

**MMF Sub-Series**
- Women Leaders in Transportation
- Wheels and Deals: Investment in Mobility
- VC and Startups in Mobility
Engagement: 2022 MMI Events

Feb - Mar 2022
- Feb 1 2022: USDOT Briefing with Secretary Buttigieg (see photo)
- Feb 16 2022: Michigan Central Visit (see photo)
- March 24 2022: MMI Members Meeting

Apr - May 2022
- April 6 2022: Zero-Emission Fleet MMI – AlphaStruxure dinner
- April 27 2022: MMI Electrification workshop
- May 19 2022: AI Policy Forum (mobility session organized by MMI)

Jun - July 2022
- July 7 2022: MMI Meetings with Ferrovial in Madrid
- July 14 2022: MMI Members Meeting
- July 26 2022: Imagining ARPA-I workshop (with The Engine and MIT Washington Office)

Oct - Nov 2022
- Oct 24-26, 2022: MMI Meetings in Japan
- Oct 28 2022: MMI Meeting with Rafael del Pino at MIT
- Nov 3 2022: MMI Vision Day
- Nov 4 2022: MMI Members Meeting
- Nov 4 2022: MMI Advisory Board Meeting

Dec 2022 - May 2023
- Dec 8 2022: Jinhua attends ARPA-I workshop with Sec Buttigieg, Robert Hampshire
- Jan 10 2023: MMI hosts MIT TRB Reception
- Feb 2 2023 – MMI Academic Advisory Council
- April 25-26 – Michigan Central Visit
- April 27 – MMI Members Meeting
- May 31st – Global Advisory Board Meeting
MIT Mobility Initiative

mmi.mit.edu
10 Trends in Mobility …
John Moavenzadeh
Q1: What topics in transportation should MMI focus on?
Q2: One wish for your local or global transportation?
(Be as specific as possible)
Q3: Who should we invite to speak at the MIT Mobility Forum (MMF)?
Breakout Room

(10 person per room)
Questions
Q1: What topics in transportation should MMI focus on?
Q2: One wish for the local or world transportation?
Q3: Who should we invite to speak at the MMF?
Please add your responses to the google doc